KENNEBUNK RIVER

MAINE

SURVEY

(REVIEW OF REPORTS)

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DECEMBER 12, 1961

SURVEY (REVIEW OF REPORTS)

KENNEBUNK RIVER, MAINE

SYLLABUS

The Division Engineer finds that the general navigation facilities at the Kennebunk River are inadequate for the present needs of the recreational and fishing fleet and that benefits are sufficient to warrant Federal improvement. He therefore recommends modification of the existing project to provide a channel 100 feet wide and 8 feet deep from the mouth of the river to the Town Landing, a distance of about 1700 feet; thence a channel 100 feet wide and 6 feet deep from the Town Landing for a distance of about 2300 feet; and from this point to the upstream limit of the Federal project, a distance of about 2000 feet, a channel 75 feet wide and 6 feet deep; 2 anchorages, one 4 acres in area and the other 2 acres in area, both 6 feet deep; the extension of the west jetty a distance of about 300 feet; and the construction of a sand fence. The estimated first cost of construction is $360,000 (Sept. 1961).

The project is recommended subject to the requirement that local interests contribute 25 percent of the construction cost, provide spoil areas, dredge berths and improve and maintain the existing public landing. The cash contribution is estimated at $90,000. The net cost to the United States is $270,000 for construction, $10,000 for preauthorization studies, and $2,000 for navigation aids with annual maintenance costs of $4,150 for the project and $150 for the navigation aids. The benefit-cost ratio is 3.9 to 1.

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U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 Trapelo Road
Waltham 54, Mass.

12 December 1961

NEDGW

SUBJECT: Survey (Review of Reports) of Kennebunk River, Kennebunkport, Maine

TO: Chief of Engineers, ATTN: ENGCW-P, Department of the Army, Washington, D. C.

AUTHORITY

1. This report is submitted in compliance with the following resolution relating to Kennebunk River, Kennebunkport, Maine adopted by the Committee on Public Works of the United States House of Representatives, United States, on 3 June 1959:

> "RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on Kennebunk River, Maine, submitted in House Document Numbered 481, Seventy-first Congress, Second Session, and prior and subsequent reports, with a view to determining whether modification of the existing project is advisable at this time."

PURPOSE AND EXTENT OF STUDY

2. This study considered the need for a modification of the existing Federal navigation project at Kennebunk River. Office and field investigations and engineering and economic studies were made of improvements requested by local interests. A detailed hydrographic survey consisting of soundings and probings was made, from which the character and estimated quantities of the material to be dredged were determined. A public hearing was held on 18 May 1960 at the Consolidated School, Kennebunkport, Maine in order to obtain the views of local interests. A data sheet dated 30 April 1960 presented by the Harbor Development Committee, Kennebunk-Kennebunkport Chamber of Commerce and other

data presented at the public hearing provided a great deal of information relative to the waterborne commerce and boating activities of the harbor. Local interests and other agencies were consulted to obtain their comments on the results of the study.

DESCRIPTION

3. The Kennebunk River is located in the southwestern part of Maine, emptying into the Atlantic Ocean about 30 miles southwest of Portland and about 15 miles northeast of York Harbor. It rises in the western part of York County and flows southeasterly about 15 miles to the Atlantic Ocean. At Kennebunkport, at the head of the existing navigation project about 1 mile above the mouth, the river is crossed by a swing highway bridge with a horizontal clearance of 39 feet and a closed vertical clearance of 5.6 feet at mean high water. The mean range of tide is 8.6 feet. Although tidewater extends to Kennebunk Landing, about 3 miles above the mouth of the river, improvement of the river by the United States has been limited to approximately the lower mile. Entrance into the river from the open sea is made between two jetties in a channel having a controlling depth of 2.5 feet. Present depths in the river channel range from 2.9 feet to 8.0 feet. Areas adjacent to the channel are generally bare at mean low water, thus limiting or restricting the use of the areas for anchorage. The locality is shown on Coast and Geodetic Survey Chart No. 1205 and on the maps accompanying this project.

TRIBUTARY AREA

4. The towns of Kennebunk and Kennebunkport, situated at the river mouth, are the principal towns on the river. In 1960 the population of Kennebunk was 4,551 and that of Kennebunkport was 1,851. This locality is a well known summer resort with many large hotels. The availability of beaches and recreational facilities attract large crowds and during the summer the population is expanded many times over the figure of year round inhabitants. During the summer there are many yachts and pleasure craft on the river. The servicing of and providing for the needs of the summer tourists is the main source of income to the towns and commercial fishing is the only year round industry.

5. The Boston and Maine Railroad services Kennebunk. An excellent system of interstate and local highways exists with U. S. Route 1 going through Kennebunk and the Maine Turnpike is easily accessible, allowing for bus, automobile and truck traffic.

BRIDGES

6. There are no bridges crossing the portion of the river for which improvements have been made or are now under consideration.

PRIOR REPORTS

7. The existing project was adopted in 1829 and supplemented by enactments to 1890. A preliminary examination report dated 22 March 1911 was made in compliance with the provisions of the River and Harbor Act of 25 June 1910. This report was unfavorable to any navigation improvements. The report under review, dated 16 June 1930, was made in compliance with the provisions of the River and Harbor Act of 21 January 1927. At that time local interests desired an increase in the channel depth to 6 feet. The report concluded that the existing project was sufficient for navigation needs at that time. No studies have been made since the 1930 report.

EXISTING CORPS OF ENGINEERS PROJECT

8. The existing project adopted in 1829, supplemented by enactments to 1890 provides for the construction of a stone breakwater on the easterly side of the river's mouth, about 550 feet long; a pier or jetty on the westerly side about 290 feet long; each on a parcel of land owned by the U. S. Government; the construction of a wharf (transferred to the Treasury Department in 1936 and now owned by the town) about 700 feet upstream from the shore end of the east breakwater; the construction of another jetty on the east bank; and securing a depth of 4 feet, by dredging and rock removal for a width of 100 feet to Kennebunkport. The existing project was completed in 1893. The project depth of 4 feet was restored in 1950 and repairs to damaged sections of the stone breakwater at the easterly side of the river's mouth were made in 1954. The total costs under the existing project have been $234,000 of which $84,000 was for new work and $150,000 for maintenance. No maintenance work has been performed in the last 5 years. The present estimate of average annual maintenance of $2,500 is consistent with that computed from actual maintenance costs over the life of the project.

LOCAL COOPERATION ON EXISTING PROJECT

9. There have been no requirements of local cooperation on the existing project.

OTHER IMPROVEMENTS

10. There have been no general harbor improvements other than that performed by the Federal Government at this location.

TERMINAL AND TRANSFER FACILITIES

11. There are 22 landings now being used along the portion of the Kennebunk River being considered for improvement. These landings include two yacht clubs, one hotel, two boat yards, 16 private landings and a public landing. Reid's Yacht Yard has two marine railways with 15 tons capacity each, open storage for 160 boats up to 45 feet in length, four berths, ten moorings and can service boats up to 55 feet in length. The Baum Boat Building Company has one marine railway with a 10-ton capacity, open storage for 35 boats up to 40 feet in length, and can service boats up to 40 feet in length. Boat building, repairs and supplies for pleasure and commercial boats are available at both yards.

12. The public landing, now owned by the town of Kennebunkport, was formerly owned by the Federal Government and was part of the original Federal project. Unloading facilities include two tackle and falls on arms. Gasoline and a fish pump are now available. The landing is of granite block construction. Fishing craft utilize this landing in transferring their catch to trucks for transportation.

IMPROVEMENT DESIRED

13. At a hearing held on 18 May 1960 at the Consolidated School, Kennebunkport, Maine, local interests expressed their desires concerning the improvement of Kennebunk River. These consisted of the following:

a. Dredging the channel to a depth of 8 feet at mean low water from the entrance up to the Town Landing and to a

depth of 6 feet at mean low water from the Town Landing to the upstream limit of the Federal project.

b. Extension of the west jetty at the entrance to stop shifting sand from forming a bar across the entrance.

c. Straightening and widening the channel to a width of 150 feet and 200 feet where feasible.

d. Removal of "Riding Rock" located adjacent to east breakwater.

14. Local interests state that a channel depth of 8 feet at mean low water is necessary as far as the Town Landing as fishing carriers with drafts of 6 and 8 feet use this wharf to transfer the catch to trucks. This depth would also be beneficial to boats of lesser draft at the entrance to the channel where wave action is more pronounced. From the Town Landing to the upstream limit of the Federal project a depth of 6 feet would suffice as this portion of the channel is rarely used by deeper draft vessels.

15. The extension of the west jetty is reported to be necessary to arrest littoral drift which causes the formation of a sand bar across the channel entrance. The existence of shifting sand has been reported in cruising guides.

16. Local interests claim that lack of anchorage space has forced users of the channel to moor their boats within the channel limit, thereby causing obstructions and a hazard to boats traversing the channel. Increasing the channel width to 150 feet and 200 feet, where feasible, would allow space for a strip anchorage.

17. Local interests also desire the removal of "Riding Rock" adjacent to the east breakwater. They state that the presence of this rock makes entrance to the channel hazardous for those unfamiliar with local conditions.

EXISTING AND PROSPECTIVE COMMERCE

18. The principal commerce of the Kennebunk-Kennebunkport area is the servicing and provisioning of summer tourists. In the summer there are many yachts and pleasure craft on

the river. There are two yacht clubs situated on the river, the Kennebunk River Club and the Arundel Yacht Club. Local interests state that there are 63 pleasure craft, including inboards, cruisers, sail boats and auxiliary sails ranging in length from 10 feet to 60 feet, permanently based on the river. In addition they say there are 43 transient pleasure boats that spend an average of 2 days each on the river. With improvement, local interests feel that there would be an increase of 20 percent on the permanently based pleasure craft and that an additional 153 transient pleasure boats would use the river spending an average of 2 days each. All types of marine supplies and repairs are available at the two boat yards, Reid's Yacht Yard and Baum Boat Building Company.

19. The only year round industry is commercial fishing. Two sardine canning companies purchase fish landed at Kennebunk River facilities. There are also three lobster companies which operate in the area. Two of these carry on a wholesale-retail business in fish, as well as lobsters. Local interests report that at present there are 38 fishing craft now using the Kennebunk River as a home port and 57 transient fishing craft spend an average of 4 days for the lobster boats and 40 days for the carriers and seiners on the river. Information furnished by local interests indicated the fish catch for the 5 year period between 1955 and 1959 averaged 262,000 pounds of lobster, 35,000 pounds of groundfish and 7,360,000 pounds of herring yearly. With improvement local interests anticipate an increase of 29 new and transferred fishing boats and 24 additional transient fishing boats utilizing the river. Available records of tonnage reported for the port totaled 14,027 tons in 1959 consisting of fish, shellfish and their products.

VESSEL TRAFFIC

20. The fishing fleet consists of 38 locally based boats and 57 transient boats. The trips per boat vary from an average of 12 trips a year for the trawlers to 145 trips a year for the lobster boats. The recreational fleet consists of 63 locally based boats and 43 transient boats annually. The total number of vessel trips reported in the Water Borne Statistics for 1959 is 42,294.

DIFFICULTIES ATTENDING NAVIGATION

21. The difficulties attending navigation on Kennebunk River are those associated with lack of depth at low tide and crowded conditions in the channel.

22. Local interests state that the entrance to the channel under present conditions is extremely hazardous. Shallow depths accompanied by pronounced wave action cause many boats to scrape bottom. The presence of "Riding Rock" at the entrance constricts the channel width. Sand is said to form a bar across the channel mouth which shifts during storms, making it dangerours for those not aware of latest conditions.

23. The channel is reported to be lacking in depth at low water. Lack of anchorage space and the number of boats now using the river has forced many boats to anchor in the channel. This has caused difficulty for boats traversing the channel and has resulted in collisions.

24. Local interests state that at least 200 boats a year drag on bottom at shoal spots in the river. They estimate that 75 boats run aground and either wait for the tide in calm weather or require local assistance to get towed off, and that 50 percent of these boats running aground in the channel sustain damage to hull, rudder, or propeller. They estimate that lobster-fishing interests using the river lose 10 percent of their available fishing time due to inability to get in or out of the river. In the winter of 1959, the lobster fishing boats were able to go out only 7 days during a 2 month period due to hazardous conditions at the river mouth. Local interests estimated that landings of $2,000,000 in herring were lost due to navigational hazards in the Kennebunk River. They also estimated that annual income lost because of navigational hazards limiting transient pleasure boat traffic amounts to at least $10,000.

WATERPOWER AND OTHER SPECIAL SUBJECTS

25. The waterway under consideration is tidal. There is no problem of waterpower, flood control, pollution or any related subject.

PLAN OF IMPROVEMENT

26. At the public hearing held in Kennebunkport, Maine on 18 May 1960, local interests requested dredging the channel to a depth of 8 feet from the channel entrance to the Town Landing and to a depth of 6 feet from the Town Landing to the upstream limit of the existing Federal project, straightening and widening the channel to 150 feet and 200 feet where feasible, extending the west jetty and removal of a rock adjacent to the east breakwater.

27. The channel was studied according to the requests of local interests. As the Town Landing is used extensively by the fishing fleet in unloading and transferring the fish catch to trucks, and carriers up to 8 feet in draft use this wharf, the depth of 8 feet to this point is necessary. As the boats going beyond this point are mainly of draft less than 6 feet, a 6-foot depth from there to the upstream limit of the Federal project is considered to be sufficient.

28. Extension of the west jetty was investigated. It is considered that by extending the west jetty the littoral drift would be impounded, thereby reducing the formation of sand bars across the channel mouth. The extension of the jetty to a length equal to the existing east jetty would also provide a scouring action and assist in maintainin the project depth at the entrance to the channel. In addition, under present condition, winds lift the sand from the beach over the existing west jetty and deposit it in the Federal project. It is believed that this could be alleviated, thereby reducing the amount of maintenance dredging required by erecting a sandfence across the front of the existing west jetty at a top elevation of 15 feet above mean low water, which is 3 feet above the existing west jetty. The fence would raise the present dune level to a sufficient height to reduce drifting of wind blown sand. Maintenance of the fence would not be necessary once the dune is formed and stabilized.

29. Straightening and widening the channel to 150 feet and 200 feet to provide additional anchorage space was investigated. There are now 101 boats, excluding rowboats and outboards, using the river as a home port. With an improvement, it is anticipated that there would be an increase of 10 new

fishing boats using the Kennebunk River as a home port. It is also anticipated that there would be an increase of 100 percent, or 63 recreational boats, during the life of the project, 30 percent taking place immediately after improvement and the remainder taking place during the next 20 years. The anticipated transient craft is considered equivalent to 4 boats a day during the boating season. This would increase the size of the local fleet to 178 boats. By realigning the channel, and narrowing it to a 75 foot width at the upper end of the project where existing wharves abut the channel, it is felt that 70 boats could berth at the existing wharves without encroaching on the channel. The realignment would also leave areas outside the channel of sufficient depth so that a number of boats could utilize these areas for anchorage and also for possible future development by local interests. In investigating for anchorage areas it was found that due to existing piers and wharves on the east side of the channel and ledge outcrops on the west side of the channel the areas that could be economically developed were limited. Two areas do exist, one on the east side of the channel the other on the west side, that could be dredged to a depth of 6 feet at mean low water and with fore and aft moorings could provide anchorage space for 108 boats. It is considered necessary to use fore and aft moorings to utilize the available area to the maximum extent.

30. Local interests also requested removal of "Riding Rock", a boulder or ledge outcrop, located adjacent to the east breakwater. This constricts the channel width at the entrance where wave action is more pronounced. The realignment of the channel between the jetties and the removal of any ledge or boulders within the channel limits would alleviate this condition and reduce the hazards involved in entering the channel.

31. In consideration of the foregoing a plan of improvement best suited to the navigation needs has been developed. This plan would modify the existing project to provide for:

a. A channel 100 feet wide and 8 feet deep at MLW from the mouth of the river to the Town Landing, a distance of about 1700 feet; thence a channel 100 feet wide and 6 feet deep at mean low water from the Town Landing for a distance of about 2300 feet; and from this point to the upstream

limit of the Federal project, a distance of about 2000 feet, a channel 75 feet wide and 6 feet deep at mean low water.

b. The extension of the west jetty a distance of about 300 feet.

c. Two anchorages, the first, 4.0 acres in area on the west side of the river and the second, 2.0 acres in area on the east side of the river, both having a depth of 6 feet at MLW, generally as shown on the inclosed map.

32. The proposed extension of the west jetty was designed to reduce shoaling by intercepting and impounding littoral drift which would otherwise move towards and into the river from the sandy shores of Kennebunk Beach to the west.

33. Stone construction for the jetty was selected as the type which would be most economical to build and maintain. A top width of 6 feet was selected for the trunk as the minimum in which riprap of adequate size could be used. The design size of slope and cap stones was based on the Waterways Experiment Station formula contained in paper by Rober Y. Hudson dated June 1957 entitled "Laboratory Investigation of Rubble-Mound Breakwaters". In the design of the tip, wave sizes used were the maximum that could be supported by depths existing at the site when the tide level was 13.5 feet above the plane of mean low water, which is an extreme storm tide. The wave height was estimated as equal to the depth divided by 1.28, a theoretical relationship derived from analysis of a so-called solitary wave.

34. State and local officials and other interests were consulted on the suitability of this plan of improvement. A meeting was held in Kennebunkport, Maine on 22 May 1961. Approval of the plan of improvement was expressed at this meeting, which was well attended by local and state officials, residents, fishermen and recreational boat owners. It was indicated that the requirements of local cooperation would be met.

SHORELINE CHANGES

35. As the west jetty would be extended no farther than the existing east jetty, it is considered that the proposed improvement would not affect the general configuration of the shoreline, other than a proportionate seaward shifting of depth contours between low water and 6 feet below low water west of the river mouth.

REQUIRED AIDS TO NAVIGATION

36. The United States Coast Guard has been consulted in regard to establishing aids to navigation for the plan of improvement. They advised that additional aids to navigation necessitated by such an improvement would have an initial cost of $2,053 with an increased annual maintenance cost of $165.

ESTIMATES OF FIRST COST

37. Estimates of first cost have been made for the improvements considered. The Federal construction consists of dredging mud, sand and gravel, removal of rock to provide the channel and anchorages, and the construction of the west jetty extension. It is considered that dredging will be accomplished by the hydraulic method and materials disposed of on areas along the river as provided by local interests. Aids to navigation would be provided by the U. S. Coast Guard.

38. The estimates of first cost for the improvement based on price levels of Sept. 1961 and including an allowance for contingencies, as detailed in Appendix A, are shown below.

Project Construction Cost

Dredging	$ 209,000
Rock Removal	6,000
Jetty Extension & Sand Fence	97,000
Preauthorization Studies	10,000
Engineering and Design	17,000
Supervision and Administration	31,000
Project Cost	$ 370,000

U. S. Coast Guard

Aids to Navigation	$ 2,000
Total First Cost (Sept 1961)	$372,000

ESTIMATES OF ANNUAL CHARGES

39. The annual charges have been computed on the basis that local interests will contribute in cash 25 percent of the construction cost of improvement as discussed below under proposed local cooperation. Federal annual charges are based on an estimated project life of 100 years and an interest rate of 2-5/8 percent. The interest rate for non-Federal investment is taken at 3.5 percent.

40. In investigating modification of the existing project, consideration was given to both the dredging of the channel and anchorages and the construction of the west jetty extension. The annual charges include an estimate for additional maintenance due to the improvement. The estimate for additional maintenance of the channel and anchorages, with the jetty extension, is based on an average shoaling rate of one foot in 15 years, an annual rate of 2,000 cubic yards. It has been estimated that replacement of 150 tons of stone would be required every 10 years for maintenance of the jetty or an annual rate of 15 tons. If the jetty were not extended, it is estimated that the outer 1,000 feet of channel would shoal at the rate of 2.5 feet every three years, making an annual rate of the entire channel and the anchorages 4,840 cubic yards.

DREDGING WITH JETTY EXTENSION

Federal Annual Charges

Interest (0.02625) ($282,000)		$ 7,400
Amortization (0.00213) ($282,000)		600
Maintenance:	Dredging (2,000 cy @$2.00)	4,000
	Jetty (15 Tons @$10.00)	150
	Navigation Aids	150
Total Federal		$12,300

Non-Federal Annual Charges	
Interest (0.035) ($90,000)	$ 3,150
Amortization (0.00116) ($90,000)	100
Total Non-Federal	$ 3,250
TOTAL PROJECT ANNUAL CHARGES	$15,550

EXTENSION OF WEST JETTY

Estimated First Cost	$ 112,000
Federal Annual Charges	
Interest & Amortization (0.02838)($84,000)	2,380
Maintenance (15 tons @$10.00)	150
Total Federal	$ 2,530
Non-Federal Annual Charges	
Interest & Amortization (0.03616)($28,000)	$ 1,010
Total Non-Federal	$ 1,010
TOTAL CHARGES ATTRIBUTED TO EXTENSION OF WEST JETTY	$ 3,540

ESTIMATES OF BENEFITS

41. Benefits have been estimated for improvement of Kennebunk River resulting from deepening the channel, providing adequate anchorage area and extending the west jetty. Tangible benefits from such improvements would accrue to both fishing and pleasure boats from the reduction or elimination of tidal delays, the increased use of the existing fleet now based in the harbor, the addition of new boats to the local fleet, as well as an increased number of transient boats and a reduction of boat damage.

42. Local interests state that lobster fishing interests lose 10 percent of their available fishing time due to inability

to get in or out of the river. They say that during a 2-month period in the winter of 1959-60 the lobster fishing boats were able to go out only 7 days due to hazardous conditions at the river's mouth. They claim that if the river were improved the lobster fleet would expand. With additional craft and reduction in lost fishing time local interests anticipate an increase of 47 percent in the lobster catch with an improvement. However, the U.S. Fish and Wildlife Service estimates an increase of 30 percent resulting from the proposed improvement. The reported lobster catch in 1959 was 313,309 pounds. An additional 30 percent would mean a 94,000-pound increase in the lobster catch attributed to an improvement. Using the present average price of $0.47 per pound, this catch is valued at $44,000. Estimating that after operating costs, the net value of the catch is 40 percent of the gross value, the benefit that would accrue to the lobster industry due to an improvement would be $17,600 for an increase in lobster catch.

43. The larger offshore lobster boats would also be engaged in trawling for groundfish. An annual increase in Maine groundfish landings of 30,000 pounds is anticipated by the U.S. Fish and Wildlife Service. Based on the current price of $0.10 per pound, the increased landings in groundfish would result in a gross benefit of $3,000. A net value of 40 percent would be a benefit of $1,200 for an increase in groundfish catch resulting from the improvement.

44. Local interests estimate that landings of $2,000,000 in herring were lost due to navigational hazards in the Kennebunk River, including lack of water depth, tidal current, and narrow channel, as well as crowded conditions in the river. This is considered to be the value of the finished project. The U. S. Fish and Wildlife Service states that additional seining activities due to the proposed improvement would add an average of 2,000,000 pounds a year to Maine landings with a gross value of $25,000 annually. A net value of 40 percent would be a benefit of $10,000 for an increase in herring catch resulting from an improvement.

45. With the existing conditions, the herring carriers experience tidal delays in the Kennebunk River. There is one carrier that makes the river its home port. This carrier reports that it loses an average of 3/4 hour on 22 trips per year because of tidal delay. Based on an operating cost of $15 per hour, the proposed navigation improvement would eliminate tidal delay,

allowing the carrier to save $11 per trip. This would be a net annual benefit of $240. Five transient carriers use the Kennebunk River facilities for 6 trips a year to unload their catch. Being unfamiliar with present depths and the location of the channel, they experience an average tidal delay of 1-3/4 hours per trip. The proposed navigation improvement would result in an annual benefit of $790 from decreased operating costs to these transient carriers. A total net benefit of $1,030 to the herring fishery through elimination of tidal delays would result from the proposed project. The report of the U. S. Fish and Wildlife Service is included in Appendix C of this report.

46. Another benefit which would accrue from the proposed improvement of Kennebunk River is a reduction in boat damage. Local interests estimate that at least 200 boats a year drag on the channel bottom at shoal spots in the river. They estimate that 75 boats run aground and either wait for the tide in calm weather or require local assistance to get towed off, and that 50 percent of the boats which run aground in the channel sustain damage to hull, rudder or propeller. The average cost of repairs is estimated at $100. With improvement, this damage would be eliminated. Assuming that the ratio between fishing and recreational boats that sustain damage is the same as the ratio of the fishing and recreational boats based on the river, 13 fishing boats and 25 pleasure boats sustain an average of $100 worth of damage each year. Elimination of this damage gives an annual benefit of $1300 for the fishing fleet and $2500 for the recreational fleet.

47. Recreational benefits for improvement of Kennebunk River have been estimated for the existing fleet of 63 locally based craft of inboards and larger size, an estimated immediate increase of 18 new boats, a gradual growth of an additional 45 new boats in the first 20 years after improvement and a number of transient craft.

48. The benefit accruing to the pleasure fleet is considered to be a part of the annual net return of the boats to their owners. The annual net return to the owners has been taken as the amount the owners would receive if they chartered to others, this amount having been computed as various percentages of the present depreciated boat value for various classes of boats, in accordance with available studies of boating practice. The estimated annual benefits to the existing fleet is shown in Table I and to the prospective fleet in Tables II and III.

TABLE I

Benefits to Existing Recreational Fleet

Type of Craft	Length (Feet)	No. of Boats	Depreciated Value Average $	Depreciated Value Total $	Percent Return Ideal	Percent Return % of Ideal Pres.	Percent Return % of Ideal Future	Percent Return Gain	Value $	On Cruise Ave. Days	On Cruise % of Season	On Cruise Value $
Inboards	10-20	7	1,200	8,400	11.0	70	90	2.2	180	1	1.1	0
Cruisers	15-30	16	4,500	72,000	8.0	60	90	2.4	1,730	4	4.0	70
Cruisers	31-50	14	8,000	112,000	8.0	50	90	3.2	3,580	5	4.0	140
Cruisers	51-60	1	10,000	10,000	8.0	40	90	4.0	400	0		0
Aux. Sails	15-30	2	5,000	10,000	10.0	60	90	3.0	300	0		0
Aux. Sails	31-40	1	8,000	8,000	10.0	60	90	3.0	240	10	6.6	20
Sailboats	10-30	22	2,000	44,000	10.0	60	90	3.0	1,320	0		
TOTALS		63		264,400					7,750			230

Net Benefit: $7,750 - 230 = $7,520

TABLE II

Benefits to Prospective Recreational Fleet (Immediate)

Type of Craft	Length (Feet)	No. of Boats	Depreciated Value Average $	Depreciated Value Total $	Percent Return Ideal	Percent Return Pres. Future	Percent Return Gain	Value $	On Cruise Ave. Days	On Cruise % of Season	On Cruise Value $
Inboards	10-20	2	1,200	2,400	11.0	90	9.9	240	0	-	-
Cruisers	15-30	4	4,500	18,000	8.0	90	7.2	1,300	4	4.0	50
Cruisers	31-50	4	8,000	32,000	8.0	90	7.2	2,300	5	4.0	90
Aux. Sails	15-30	1	5,000	5,000	10.0	90	9.0	450	0	0	-
Aux. Sails	31-40	2	8,000	16,000	10.0	90	9.0	1,440	10	6.6	100
Sailboats	10-30	5	2,000	10,000	10.0	90	9.0	900	0		0
TOTALS		18		83,400				6,630			240

Net Benefit: $6,630 - 240 = $6,390

TABLE III

Benefits to Prospective Recreational Fleet (Gradual Growth)

Type of Craft	Length (Feet)	No. of Boats	Depreciated Value Average $	Depreciated Value Total $	Percent Return Ideal	Percent Return Pres. Future	Percent Return Gain	Value $	On Cruise Ave. Days	On Cruise % of Season	On Cruise Value $
Inboards	10-20	4	1,200	4,800	11.0	90	9.9	480	0	-	-
Cruisers	15-30	10	4,500	45,000	8.0	90	7.2	3,240	4	4.0	130
Cruisers	31-50	11	8,000	88,000	8.0	90	7.2	6,340	5	4.0	250
Cruisers	51-60	3	10,000	30,000	8.0	90	7.2	2,160	10	6.6	140
Aux. Sails	15-30	2	5,000	10,000	10.0	90	9.0	900	0	-	
Aux. Sails	31-40	3	8,000	24,000	10.0	90	9.0	2,160	10	6.6	140
Sailboats	10-30	12	2,000	24,000	10.0	90	9.0	2,160	0	-	
TOTALS		45		225,800				17,440			660

$17,440 - $660 = $16,780

In 20 years the fleet will have expanded to the capacity of the improvement. Average annual equivalent for 100 years life of project @ 4% is 0.70077. Benefits to recreational craft are taken as an economic return to private economy.

$16,780 x .70077 = $11,760

49. Recreational benefits have been claimed from the increased use of the present transient fleet due to the harbor improvement along with the expansion of this fleet. Table IV shows the value of the annual net return for the present and for prospective transient fleets.

TABLE IV

Benefits to Transient Recreational Craft

Type of Craft	Length (Feet)	No. of Boats	Ave. Days in Hbr.	Boat Days	% of Season	Ave. Dep. Value	Percent of Return				Value $
							Ideal	Pres.	Future	Gain	
Recreational Craft (Presently Visiting)											
Cruisers	15-30	10	2	20	22.2	4,500	8.0	60	90	2.4	20
Cruisers	31-50	25	2	50	40.0	8,000	8.0	50	90	3.2	100
Aux. Sails	15-30	5	2	10	11.1	5,000	10.0	60	90	3.0	20
Aux. Sails	31-40	3	2	6	4.0	8,000	10.0	60	90	3.0	10
Recreational Craft (Prospective Visitors)											
Cruisers	15-30	20	2	40	44.4	4,500	8.0	-	90	7.2	140
Cruisers	31-50	75	2	150	120.0	8,000	8.0	-	90	7.2	690
Cruisers	51-60	10	2	20	13.3	10,000	8.0	-	90	7.2	100
Aux. Sails	15-30	15	2	30	33.3	5,000	10.0	-	90	9.0	150
Aux. Sails	31-40	30	2	60	40.0	8,000	10.0	-	90	9.0	290
Aux. Sails	41-60	3	2	6	4.0	10,000	10.0	-	90	9.0	40
TOTALS		196									1,560

50. Benefits from increased fish catch and to commercial fishing boats are considered general in nature. Benefits to recreational craft are considered 50 percent general and 50 percent local benefit. The tangible benefits which are estimated to accrue from the proposed improvement of Kennebunk River are summarized below:

Sources of Benefit	General	Local	Total
Fishing Fleet			
Increased Lobster Catch	$17,600		$17,600
Increased Groundfish Catch	1,200		1,200
Increased Herring Catch	10,000		10,000
Tidal Delay Cost to Carriers	1,030		1,030
Reduced Damage	1,300		1,300
Recreational Boating			
Existing Fleet	3,760	$3,760	7,520
New Boats (Immediate)	3,195	3,195	6,390
New Boats (Gradual Growth)	5,880	5,880	11,760
Transient (Present & Prospective)	780	780	1,560
Reduced Damage	1,250	1,250	2,500
	$45,995	$14,865	$60,860
	75%	25%	100%

51. In addition to the tangible benefits described above, certain intangible benefits would accrue from the provision of safe and adequate navigation and mooring facilities. As this area is a well-known summer resort there would be an increase in the navigation traffic. This would result in additional local revenue from supplying the needs of the tourists. These benefits, although real and of significance to the area, are considered to be secondary benefits and therefore have not been evaluated.

52. It is considered that extension of the west jetty would reduce the amount of shoaling in the channel. In evaluating the jetty extension, the difference in the estimated amount of shoaling that would occur without the jetty extension and with the extension is estimated to be sufficient to justify extending the jetty. This amount is computed to be 2,840 cubic yards @ $2.00 or $5,680.

COMPARISON OF BENEFITS AND COSTS

53. A comparison of the estimated annual benefits for the entire improvement under consideration, totalling $60,860 and the estimated annual charges totalling $15,550 results in a benefit-cost ratio of 3.9.

PROPOSED LOCAL COOPERATION

54. The benefits to be derived from the proposed improvement are both general and local in nature. It is considered that local interests should be required to bear a share of the total project costs in proportion to the percent of local benefits involved. The apportionment of costs between the United States and local interests, based on the percentage of local benefits applied to the project construction cost, requires that local interests make a cash contribution of 25 percent of the cost of the proposed construction. The local cash contribution is presently estimated at $90,000.

55. Local interests should also be required to agree to hold and save the United States free from damages due to the construction and maintenance of the improvement, and to provide without cost to the United States all lands, easements and rights-of-way necessary for the construction of the project and for the subsequent maintenance thereof.

56. To assure full public use of the improvement, local interests should be required to improve and maintain the existing public landing which would be open to all on an equal basis.

57. Spoil disposal areas would be needed for the material to be dredged from the river and should be furnished by local interests.

58. The total estimated cost to local interests is $90,000. Local interests were consulted on the indicated requirements of local cooperation. At a meeting held on 22 May 1961 in Kennebunkport, Maine, with state and local officials, approval was expressed in the plan of improvement. Subsequent letters, which are included in the appendix of this report, from the Maine Port Authority and the Towns of Kennebunk and Kennebunkport indicated that the requirements of local cooperation would be met.

APPORTIONMENT OF COSTS AMONG INTERESTS

59. An apportionment of costs has been made so that local interests bear a portion of the cost of the general navigation facilities commensurate with the local benefits. The construction cost of the general navigation facilities is $360,000, the cost of the channel, anchorages and jetty extension, excluding the pre-authorization study costs. Local benefits have been computed as 25 percent of the total benefits. The Federal and non-Federal investment resulting from this apportionment is as follows:

Federal Investment	
Corps of Engineers	
General Navigation Facilities (0.75) ($360,000)	$270,000
Preauthorization Studies	10,000
Coast Guard	
Navigation Aids	2,000
TOTAL FEDERAL INVESTMENT	$282,000
Non-Federal Investment	
Cash Contribution (0.25)($360,000)	$ 90,000
TOTAL NON-FEDERAL INVESTMENT	$ 90,000
TOTAL INVESTMENT	$372,000

COORDINATION WITH OTHER AGENCIES

60. All Federal, State and local agencies known to have an interest in the development and use of waterways were notified of the public hearing on the proposed improvement held at Kennebunkport, Maine on 18 May 1960. Officials of the Maine Port Authority and the Towns of Kennebunk and Kennebunkport and pleasure and fishing boat interests were consulted during the study concerning the effects of the proposed improvement on their activities. State and local officials have expressed approval of the proposed improvements.

61. The U. S. Coast Guard was advised of the improvement under consideration and requested to comment on aspects pertaining to their interests. By letter of 22 June 1961 the Commander of the First Coast Guard District submitted a cost estimate for additional aids to navigation. These costs have been included in the Federal costs of the project.

62. The U.S. Fish and Wildlife Service was also requested to comment on the plan of improvement. Their report (see Appendix C) indicated that with the exception of possible use of marshes as disposal sites they could foresee no significant adverse effects of the proposed project on the fish and wildlife resources and habitat. They therefore recommended that the U.S. Fish and Wildlife Service, the Maine Department of Inland Fisheries and Game, and the Maine Department of Sea and Shore Fisheries be consulted in the selection of spoil disposal areas related to the project.

DISCUSSION

63. The Kennebunk River is located in the southwestern part of Maine, emptying into the Atlantic Ocean about 30 miles southwest of Portland and about 15 miles northeast of York Harbor. It rises in the western part of York County and flows southeasterly about 15 miles to the Atlantic Ocean. The mean range of tide is 8.6 feet. Federal improvement of Kennebunk River has been limited to approximately the lower mile.

64. In the area immediately tributary to Kennebunk River are the towns of Kennebunkport and Kennebunk, a well-known summer resort area. At present there are 38 fishing and 63 recreational craft which use the harbor as a home port. At low water many of these vessels scrape bottom. Lack of anchorage space forces them to moor in the channel and shifting sand at the channel entrance makes access to the channel difficult.

65. The Federal navigation project for Cape Porpoise Harbor, which is also located in the town of Kennebunkport, Maine, about 3 miles northeast of the Kennebunk River, was modified in 1950 to provide an anchorage 100 feet wide, 2,000 feet long and 6 feet deep at the head of Porpoise Cove. As in the lower Kennebunk River area, the congestion of both recreational and fishing boats anchored in the existing project area is intensifying. Since completion of the modification work, recreational and commercial use of Cape Porpoise Harbor has shown notable growth. Over 900 boats utilized the harbor in 1960, including 3 trawlers, 8 to 10 draggers, and some 80 full-time lobster boats. One of the three buyers based at the harbor, the Maine Lobstermen's Association Cooperative, reported the purchase of some 250,000 pounds of lobster and 30,000 pounds of groundfish and herring during 1960. Boating activity during the peak summer season is increasing to such extent at both localities that prospective improvements in one area would not materially change congested conditions in the other project area.

66. At a public hearing held in Kennebunkport, Maine on 18 May 1960, local interests requested that the existing Federal project be modified to provide for the dredging of the channel to a depth of 8 feet from the entrance to the Town landing and to a depth of 6 feet from the Town landing to the upstream limit of the Federal project; the extending of the west jetty; the straightening and widening of the channel to a width of 150 feet and 200 feet; and the removal of a rock at the channel entrance.

67. In view of the size of craft that would use the harbor, the needs of present and prospective navigation could be met by modifying the existing project to provide: a channel 100 feet wide and 8 feet deep for 1700 feet, 100 feet wide and 6 feet deep for 2300 feet, and 75 feet wide and 6 feet deep for 2000 feet; extension of the west jetty for about 300 feet; and an anchorage of 4.0 acres, 6 feet deep on the west side of the river and an anchorage of 2.0 acres, 6 feet deep on the east side of the river. This improvement would result in an increased use of the existing recreational fleet as well as an expansion of that fleet. An increase of 63 boats in the recreational fleet has been estimated over the life of the project. With 10 additional fishing boats, the total fleet over the life of the project is expected to number 174 locally based boats. In addition the number of recreational transient craft anticipated to use the harbor over the project life is equivalent to 4 permanently based craft.

68. The improvement of the harbor by a modification of the Federal project consisting of a 100' channel 8 and 6 feet deep, a 75' channel 6 feet deep, anchorage basins of 4.0 and 2.0 acres 6 feet deep, and the extension of the west jetty can be accomplished at an estimated cost of $360,000 (Sept. 1961), exclusive of $10,000 for preauthorization studies, and $2,000 for navigation aids by the Coast Guard. The total investment would therefore be $372,000. The annual charges of $15,550 and the evaluated benefits of $60,860 result in a fevorable benefit-cost ratio of 3.9 to 1.

69. Local interests should bear a share of the first cost of the general navigation facilities proportionate to the local benefits to be realized from the improvement. Such an allocation requires a local cash contribution of 25 percent. On the basis of the presently estimated construction cost of $360,000, the

local cash contribution would be $90,000. The total costs to be borne by the Federal Government are estimated at $270,000 for project construction, $2,000 for navigation aids, and $10,000 for preauthorization studies, a total of $282,000.

CONCLUSIONS

70. The general navigation facilities at Kennebunk River are inadequate for the present needs of recreational craft and the fishing fleet. The improvement of Kennebunk River would increase the fish catch, use of recreational craft and reduce boat damage and mooring congestion. The benefit-cost ratio for a Federal improvement is 3.9 to 1, indicating it is economically justified. In view of the nature of the work needed and the benefits therefrom a Federal project is considered warranted.

71. It is the opinion of the Division Engineer that local interests should be required to contribute 25 percent (about $90,000 at 1961 price levels) toward the construction costs of the proposed improvement. In addition, local interests should hold the United States free from claims for damages that might arise from construction of the improvement. The share of the first cost to be borne by the United States is $270,000 exclusive of $10,000 for preauthorization studies and $2,000 for additional navigation aids, for a total estimated Federal cost of $282,000 (Sept. 1961). If the project is authorized, funds for the entire improvement should be appropriated in one fiscal year to assure economical prosecution of the work. The local cash contribution should be furnished in one lump sum prior to commencement of the work.

72. State and local officials have been consulted regarding the proposed improvement and have expressed approval of the plan and indicated that the requirements of local cooperation, set forth above, will be provided when required.

73. The U.S. Fish and Wildlife Service has been consulted. The fish benefits anticipated by the U. S. Fish and Wildlife Service are listed in their report and have been incorporated in the economic evaluation of the project. No significant adverse effects of the proposed project on the fish and wildlife resources and habitat were foreseen with the exception of the possible use of marshes as spoil disposal sites. Further coordination with the Fish and Wildlife Service, the Maine Department of Inland Fisheries and Game, and Maine Department of Sea and Shore Fisheries

will be required in the selection of spoil disposal areas when the project is constructed.

RECOMMENDATION

74. Modification of the Federal navigation project for Kennebunk River, Maine, is recommended to provide for a channel 100 feet wide with a depth of 8 feet for the first 1,700 feet, a depth of 6 feet for the next 2,300 feet, and 75 feet wide and a depth of 6 feet for the final 2,000 feet; for 2 anchorages, one of 4 acres the other of 2 acres, both 6 feet deep; and for the extension of the west jetty a distance of about 300 feet and the construction of a sand fence, all as shown on the inclosed map. The estimated construction cost is $360,000 (Sept. 1961) and the annual maintenance cost is $4,150.

75. This improvement is recommended subject to the conditions that prior to construction local interests agree to:

a. Contribute in cash 25 percent of the cost of construction, and that such contribution, presently estimated at $90,000, be paid in a lump sum prior to commencement of the work, the final allocation of costs to be made after actual costs have been determined.

b. Hold and save the United States free from damages due to construction and maintenance of the project.

c. Improve and maintain the existing public landing open to all on equal terms with access to the dredged channel.

d. Provide without cost to the United States all lands, easements, rights-of-way, and spoil disposal areas for the construction and maintenance of the project; when and as required.

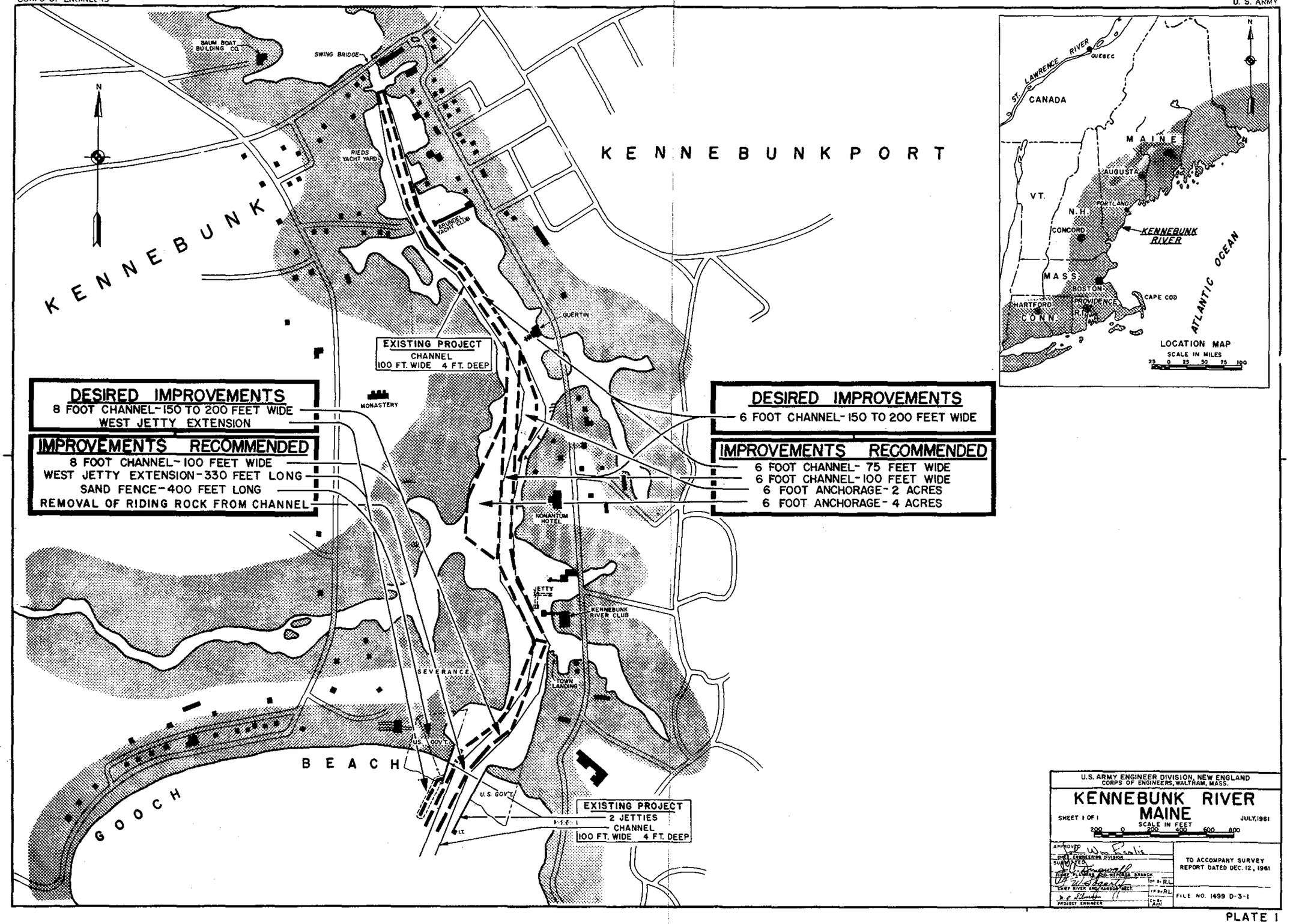
76. The net cost to the United States for the recommended plan of improvement is estimated at $270,000 for construction and $4,150 annually for maintenance. Other Federal costs are $10,000 for preauthorization studies and $2,000 for navigational aids with $150 annually for maintenance of these aids. Local costs are estimated at $90,000 (1961) for the cash contribution.

4 Incl
1. Maps - Plates 1 & 2
2. Estimate of First Cost Appendix A
3. Jetty Extension-Appendix B
4. Fish & Wildlife Report Appendix C
5. Senate 148 Resolution

SEYMOUR A. POTTER, JR.
Brigadier General, USA
Division Engineer

CORPS OF ENGINEERS

U. S. ARMY



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS, WALTHAM, MASS.

KENNEBUNK RIVER
MAINE

SHEET 1 OF 1

SCALE IN FEET
200 0 200 400 600 800

JULY, 1961

APPROVED: Wm Scalis
CHIEF, ENGINEERING DIVISION

SURVEYED: [illegible]
CHIEF, PLANNING AND REPORTS BRANCH

[illegible]
CHIEF RIVER AND HARBOR SECT. — CHK. BY R.L.

[illegible]
PROJECT ENGINEER — CHK. BY R.L.

TO ACCOMPANY SURVEY REPORT DATED DEC. 12, 1961

FILE NO. 1499 D-3-1

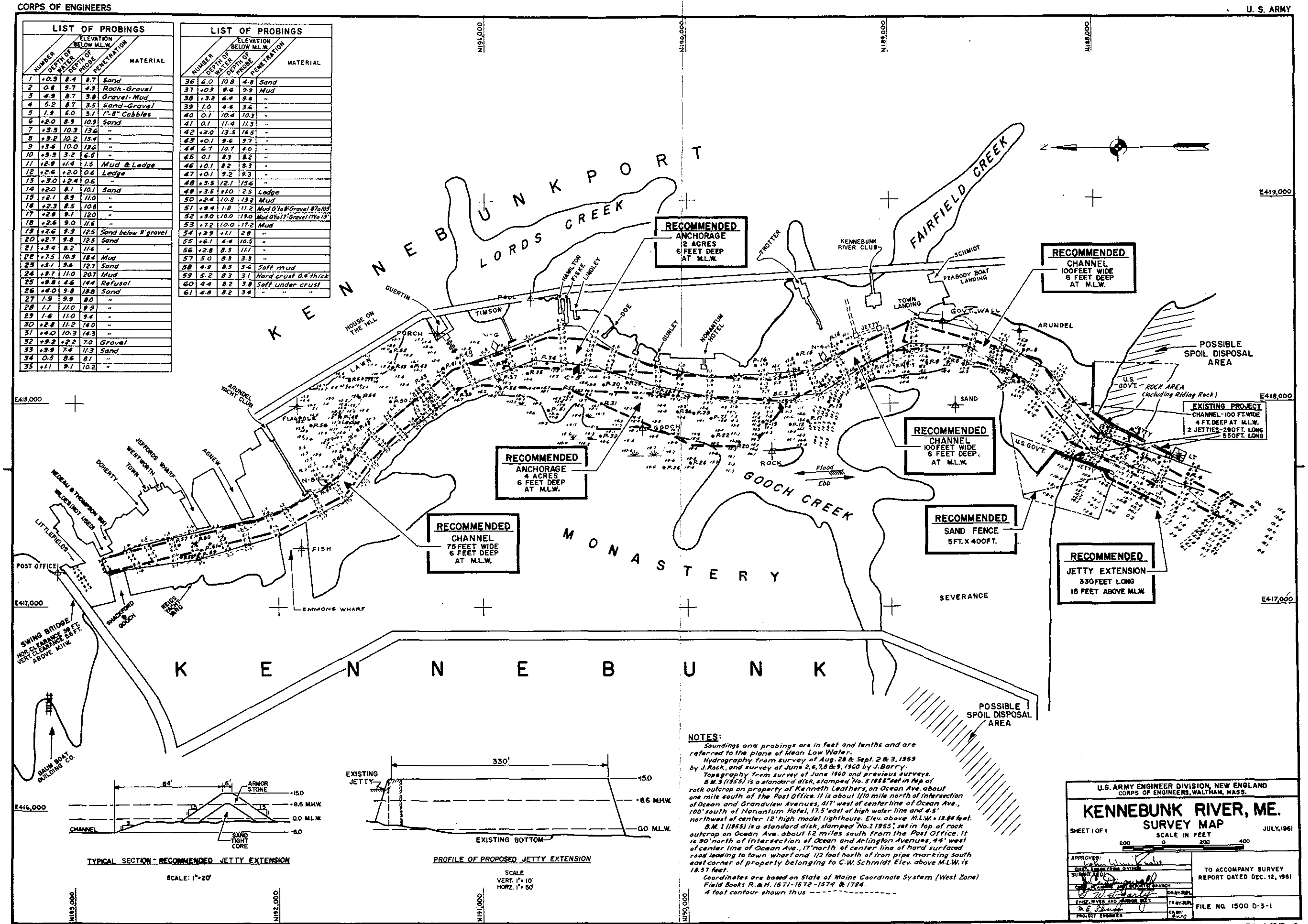
PLATE 1

LIST OF PROBINGS

NUMBER	DEPTH OF WATER (ELEVATION BELOW M.L.W.)	DEPTH OF PROBE (ELEVATION BELOW M.L.W.)	PENETRATION	MATERIAL
1	+0.9	8.4	8.7	Sand
2	0.8	5.7	4.9	Rock-Gravel
3	4.9	8.7	3.8	Gravel-Mud
4	5.2	8.7	3.5	Sand-Gravel
5	1.9	5.0	3.1	1"-8" Cobbles
6	+2.0	8.9	10.9	Sand
7	+3.3	10.3	13.6	"
8	+3.2	10.2	13.4	"
9	+3.6	10.0	13.6	"
10	+3.3	3.2	6.5	"
11	+2.9	+1.4	1.5	Mud & Ledge
12	+2.6	+2.0	0.6	Ledge
13	+3.0	+2.4	0.6	"
14	+2.0	8.1	10.1	Sand
15	+2.1	8.9	11.0	"
16	+2.3	8.5	10.8	"
17	+2.9	9.1	12.0	"
18	+2.6	9.0	11.6	"
19	+2.6	9.9	12.5	Sand below 9' gravel
20	+2.7	9.8	12.5	Sand
21	+3.4	8.2	11.6	"
22	+7.5	10.9	18.4	Mud
23	+3.1	9.6	12.7	Sand
24	+9.7	11.0	20.7	Mud
25	+9.8	4.6	14.4	Refusal
26	+4.0	9.8	13.8	Sand
27	1.9	9.9	8.0	"
28	1.1	11.0	9.9	"
29	1.6	11.0	9.4	"
30	+2.8	11.2	14.0	"
31	+4.0	10.3	14.3	"
32	+9.2	+2.2	7.0	Gravel
33	+3.9	7.4	11.3	Sand
34	0.5	8.6	8.1	"
35	+1.1	9.1	10.2	"

LIST OF PROBINGS

NUMBER	DEPTH OF WATER (ELEVATION BELOW M.L.W.)	DEPTH OF PROBE (ELEVATION BELOW M.L.W.)	PENETRATION	MATERIAL
36	6.0	10.8	4.8	Sand
37	+0.3	9.6	9.9	Mud
38	+3.2	6.4	9.6	"
39	1.0	4.6	3.6	"
40	0.1	10.4	10.3	"
41	0.1	11.4	11.3	"
42	+3.0	13.5	16.5	"
43	+0.1	9.6	9.7	"
44	6.7	10.7	4.0	"
45	0.1	8.3	8.2	"
46	+0.1	8.2	8.3	"
47	+0.1	9.2	9.3	"
48	+3.5	12.1	15.6	"
49	+3.5	+1.0	2.5	Ledge
50	+2.4	10.8	13.2	Mud
51	+9.4	1.8	11.2	Mud 0'to 8'-Gravel 8'to 10.5'
52	+9.0	10.0	19.0	Mud 0'to 17'-Gravel 17'to 19'
53	+7.2	10.0	17.2	Mud
54	+3.9	+1.1	2.8	"
55	+6.1	4.4	10.5	"
56	+2.8	8.3	11.1	"
57	5.0	8.3	3.3	"
58	4.9	8.5	3.6	Soft mud
59	5.2	8.3	3.1	Hard crust 0.4' thick
60	4.4	8.2	3.8	Soft under crust
61	4.8	8.2	3.4	" " "



NOTES:

Soundings and probings are in feet and tenths and are referred to the plane of Mean Low Water.

Hydrography from survey of Aug. 28 & Sept. 2 & 3, 1959 by J. Rock, and survey of June 2, 6, 7, 8 & 9, 1960 by J. Barry.

Topography from survey of June 1960 and previous surveys.

B.M. 3 (1955) is a standard disk, stamped "No. 3 1955" set in top of rock outcrop on property of Kenneth Leathers, on Ocean Ave. about one mile south of the Post Office. It is about 1/10 mile north of intersection of Ocean and Grandview Avenues, 417' west of centerline of Ocean Ave., 100' south of Nonantum Hotel, 17.5' east of high water line and 4.6' northwest of center 12' high model lighthouse. Elev. above M.L.W. = 18.84 feet.

B.M. 1 (1955) is a standard disk, stamped "No. 1 1955", set in top of rock outcrop on Ocean Ave. about 1.2 miles south from the Post Office. It is 90' north of intersection of Ocean and Arlington Avenues, 44' west of center line of Ocean Ave., 17' north of center line of hard surfaced road leading to town wharf and 1/2 foot north of iron pipe marking south east corner of property belonging to C.W. Schmidt. Elev. above M.L.W. is 18.57 feet.

Coordinates are based on State of Maine Coordinate System (West Zone) Field Books R. & H. 1571-1572-1574 & 1794.

4 foot contour shown thus ----------

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS, WALTHAM, MASS.

KENNEBUNK RIVER, ME.
SURVEY MAP

SHEET 1 OF 1 — JULY, 1961

SCALE IN FEET: 200 0 200 400

APPROVED: CHIEF, ENGINEERING DIVISION
SUBMITTED: CHIEF, PLANNING AND REPORTS BRANCH
CHIEF, RIVER AND HARBOR SECT.
PROJECT ENGINEER
DR. BY: R.P.L. TR. BY: R.P.L. CK. BY:

TO ACCOMPANY SURVEY REPORT DATED DEC. 12, 1961

FILE NO. 1500 D-3-1

SURVEY OF KENNEBUNK RIVER, MAINE

APPENDIX A

ESTIMATE OF FIRST COST - ENTIRE IMPROVEMENT

1. The first cost is given below for the improvement recommended in this report. Federal construction consists of dredging and rock removal to provide a 100-foot wide channel, 8 and 6 feet deep, a 75-foot wide channel, 6 feet deep, 4 and 2 acre anchorages and the extension of the west jetty a distance of about 300 feet, including provision of a sand fence.

2. Probings made during the study indicate that dredging will consist of mud, sand and gravel which can be removed by hydraulic dredge. There is a small amount of rock, boulders or ledge, to be removed from the outer end of the channel. Dredging quantities are in terms of in-place measurement and include an allowance of 1 foot of overdepth. Side slopes of 1 vertical on 3 horizontal were used. Cost estimates are based on price levels prevailing in Sept. 1961.

3. The detailed estimate of cost is as follows:

PROJECT COST ESTIMATE

(Amounts in Thousands of Dollars)

Cost Account Number	Item		Cost Estimate (May 1961)
09	Channels - 8' and 6' Channel 6' Anchorage		
	(Dredging 140,000 c.y. @ $1.30	182,000	
	(Contingencies @ 15%	27,000	209,000
	Rock Removal		
	(100 c.y. @ $50	5,000	
	(Contingencies @ 15%	1,000	6,000
	Jetty & Sand Fence		
	(10,800 Tons @ $7.75	84,000	
	400 linear ft. fence @ $2.50	1,000	
	(Contingencies @ 15%	12,000	97,000

Cost Account Number	Item	Cost Estimate (May 1961)
29	Preauthorization Studies	10,000
30	Engineering and Design	17,000
31	Supervision and Administration	31,000
	TOTAL COST (Corps of Engineers Funds and non-Federal Contributions)	370,000
	Non-Federal Contributions	90,000
	TOTAL NON-FEDERAL COSTS	
	Lands and Damages	0
	Relocations	0
	Other	
	Cash Contribution (25% of 360.0)	90,000
	Total Non-Federal Costs	90,000
	SUMMARY OF ESTIMATED COSTS	
	Federal Cost	
	Corps of Engineers	280,000
	U. S. Coast Guard	2,000
	Required non-Federal Costs	
	Cash Contribution	90,000
	TOTAL FEDERAL AND REQUIRED NON-FEDERAL COSTS	$372,000
	Estimate of First Cost - Jetty Extension Only	
09	Jetty and Sand Fence	$ 97,000
30	Engineering and Design	5,000
31	Supervision & Administration	10,000
	Total Cost	$112,000
	Federal Cost - 75% =	84,000
	Non-Federal Cost - 25% =	28,000

SURVEY OF KENNEBUNK RIVER, MAINE

APPENDIX B

DESIGN OF JETTY EXTENSION

1. The proposed extension of the west jetty was designed to reduce shoaling by intercepting and impounding littoral drift which would likely move towards and into the river from the sandy shores of Kennebunk Beach.

2. Stone construction for the jetty was selected as the type which would be most economical to build and maintain.

3. The design size of slope and cap stones was based on the Waterways Experiment Station formula contained in paper by Robert Y. Hudson dated June 1957 entitled "Laboratory Investigation of Rubble-Mound Breakwaters". Design criteria and resulting dimensions are as follows:

Jetty Tip

Tide - 12 feet (extreme storm tide)
Water depth - 1.5 feet
Still Water level - 13.5 feet
Design wave - 10.5 feet (SWL divided by 1.28)
Kd - 2.5 (breaking wave, structure head)
Cap stone - 5 tons
Slope - 1 on 2
Length - 10 feet
Crest height - 15 feet above MLW
Crest width - 10 feet

Jetty Trunk

Design Wave - 7.5 feet
Kd - 2.8 (breaking wave, structure trunk)
Cap stone - 2.5 tons
Slope - 1 on 1.5
Length - 320 feet
Crest height - 15 feet above MLW
Crest width - 6 feet

4. The trunk of the proposed jetty extension would be protected from waves coming from the southeast by the existing east jetty, from the south by the jetty tip, and from the southwest by Kennebunk Beach. Overtopping is not a consideration. Therefore, provision of a flatter slope of 1 on 2, using heavier stone, at the end of the jetty with a transition to a steeper slope of 1 on 1.5 would be sufficient strength at the end of the jetty.

APPENDIX C

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

September 7, 1961

Division Engineer
New England Division
U. S. Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Sir:

With regard to your navigation study of Kennebunk River, Maine, this letter constitutes our conservation and development report on the fish and wildlife resources. This report has the concurrence of the Maine Departments of Sea and Shore Fisheries and Inland Fisheries and Game.

Improvements under consideration consist of deepening the river channel to a depth of 6 feet, providing increased anchorage areas, and extension of the west breakwater at the mouth of the river.

Benefits to the lobster, herring, and groundfish fisheries will result from the harbor improvements. The proposed project will give the lobster fishermen better access to facilities and allow them to expand their fishing operations. The annual local lobster landings will increase by approximately 30%, adding 94,000 lbs. to the Maine catch. These increased annual landings of lobsters would result in a gross benefit of $44,000 to the fishermen.

The larger offshore lobster boats would also be engaged in trawling for groundfish. An annual increase in Maine groundfish landings of 30,000 lbs. is anticipated. Based on the current price of 10¢ per lb., the increased landings in groundfish would result in a gross benefit of $3,000.

The herring fishery would receive some benefits from an improved channel in the Kennebunk River. Additional seining activities would add an average of 2,000,000 lbs. a year to Maine landings with a gross value of $25,000 annually.

With the existing conditions, the herring carriers experience tidal delays in the Kennebunk River. There is one carrier that makes the river its home port. This carrier reports that it loses an average of 3/4 hour on 22 trips per year because of tidal delay. Based on an

operating cost of $15 per hour, the proposed navigation improvement would eliminate tidal delay, allowing the carrier to save $11 per trip. This would be a net annual benefit of $240. Five transient carriers use the Kennebunk River facilities for 6 trips a year to unload their catch. Being unfamiliar with present depths and the location of the channel, they experience an average tidal delay of 1-3/4 hours per trip. The proposed navigation improvement would result in an annual benefit of $790 from decreased operating costs to these transient carriers. A total net benefit of $1,030 to the herring fishery would result from the proposed project.

In summary, the gross values of the increased Maine landings in the commercial lobster, groundfish, and herring fisheries that we attribute to the project are: $44,000, $3,000, and $25,000 annually. An annual net benefit due to savings in cost by the herring carrier boats would amount to $1,030.

With the exception of the possible use of marshes as disposal sites we can foresee no significant adverse effects of the proposed project on the fish and wildlife resources and habitat.

Therefore, we recommend that the Fish and Wildlife Service, the Maine Department of Inland Fisheries and Game, and the Maine Department of Sea and Shore Fisheries be consulted in the selection of spoil disposal areas related to the proposed project.

Thank you for giving us an opportunity to report on this plan of improvement.

Sincerely yours,

John S. Gottschalk
Regional Director
Bureau of Sport Fisheries & Wildlife

John T. Gharrett
Regional Director
Bureau of Commercial Fisheries

KENNEBUNK RIVER, MAINE

Information Called for by Senate
Resolution 148, 85th Congress.
Adopted 28 January 1958

1. Navigation Problems. Kennebunk River is located in the southwestern part of Maine about 30 miles southwest of Portland and about 15 miles northeast of York Harbor. It is used by small fishing and recreational craft. The mean range of tide is 8.6 feet.

2. The chief difficulties are lack of depth in the channel, lack of anchorage space and hazardous conditions at the river's mouth.

3. Improvement Considered. Local interests expressed the need for dredging the river to a depth of 8 feet from the mouth of the river to the Town landing and to a depth of 6 feet from the Town landing to the upstream limit of the Federal project. Local interests desired extension of the west breakwater to provide additional protection and to arrest littoral drift. Local interests also requested the removal of a rock at the channel mouth and the straightening and widening of the channel to a width of 150 to 200 feet.

4. Recommended Improvements. To eliminate tidal delays and provide sufficient anchorage, the improvement recommended provides for a channel 100 feet wide, 8 feet deep for 1700 feet, and 6 feet deep for 2300 feet; a channel 75 feet wide, 6 feet deep for 2000 feet; 4 and 2 acre anchorages, 6 feet deep; and the extension of the west jetty a distance of about 300 feet. Estimated first costs, annual costs and annual benefits based on September 1961 price levels, a 100-year project life, and an interest rate of 2-5/8 percent for Federal funds and 3.5 percent for non-Federal funds are as follows:

a. Estimated First Costs of Construction:

Federal	$ 270,000*
Non-Federal	90,000**
Total Estimated First Costs of Construction	$ 360,000

* Excludes preauthorization costs of $10,000 and navigation aids of $2,000.

** Cash contribution of 25 percent construction cost

b. Estimated Annual Charges:

	Federal	Non-Federal	Total
Interest and Amortization	$ 8,000	$ 3,250	$11,250
Maintenance	4,300		4,300
Total Estimated Annual Charges	$12,300	$ 3,250	$15,550

c. Estimated Annual Benefits:

	General	Local	Total
Commercial Fishing	$29,830	0	$29,830
Recreational	13,615	$13,615	27,230
Boat Damage			
Fishing	1,300	0	1,300
Recreational	1,250	1,250	2,500
Total Estimated Annual Benefits	$45,995	$14,865	$60,860

d. Benefit-Cost Ratio = 3.9

5. Apportionment of Cost and Local Cooperation. In view of the local benefits, local interests would be required to contribute in cash 25 percent of the cost of construction. The authorized project would be subject to the conditions that local interests:

a. Make a cash contribution of 25 percent of the construction costs of the improvement, a contribution currently estimated at $90,000.

b. Improve and maintain the existing public landing open to all on equal terms.

c. If it is determined after detailed studies that spoil disposal areas are needed, local interests should, upon request of the Chief of Engineers and without cost to the United States, furnish any such dikes, bulkheads and embankments as may be necessary for the initial construction and subsequent maintenance.

d. Provide without cost to the United States all necessary lands, easements, and rights-of-way for the construction and subsequent maintenance of the project.

e. Hold and save the United States free from damages that may result from construction and subsequent maintenance of the project.

6. Discussion. Local interests have approved the recommended plan and indicated that the requirements of local cooperation would be met. The measures recommended provide a logical and economically feasible means of meeting the needs of navigation in the harbor. The project is considered justified on the basis of studies and criteria in the report. Proposed local cooperation is consistent with other similar projects.